ECOLOGICAL, SOCIAL AND ECONOMICAL FACTORS INFLUENCING THE LEVEL OF TEA PRODUCTION IN NANDI HILLS SUB-COUNTY.

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A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF MANAGEMENT AND LEADERSHIP IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF DEVELOPMENT STUDIESOF THE MANAGEMENT UNIVERSITY OF AFRICA.

JUNE, 2018

DECLARATION

This research project is my original work, and it has not been presented for a degree in any other university.

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JusterNyaga

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DEDICATION

This project is dedicated to Nandi Hills Tea Farmers.

ACKNOWLEDGEMENT

I would wish to acknowledge the Management University of Africa, my Supervisor for the support and assistance given to me during the research work and I also acknowledge the Nandi hills tea farmers for the cooperation and assistance during the research work, God bless you all.

ABSTRACT

Kenya is experiencing expansion in tea production despite of declined world tea prices and also overall tea consumption. Kenya is a country with tea expansion trend in an environment of stagnating prices. The general objective of this study was to assess the influence of ecological and social economic factors on the level of tea production in Nandi Hills Sub-County. The target population composed of 5,827 tea farmers while theaccessible population was 3729 smallholder tea farmers who deliver green leaf to all the tea factory clusters in Nandi Hills Sub-County. This study used a stratified random sampling technique to select smallholder farmers to study respondents. A sample size of 375 small holder farmers and ten agricultural extension officers were selected to inform the study. The study used farmer questionnaires and interviews with agricultural extension officers to obtain primary data for the study. Statistical package for social sciences (SPSS) version 22was used for quantitative data analysis.Descriptive statistics such as frequencies, measures of central tendencies (mean, medium or mode) and measures of dispersion (standard deviation, range or variance) will be used for the study. Qualitative data, especially from the interviews,were reported in verbatim, transcribed and coded according to various themes, categories and sub-categories as per objectives as they emerge during the study using NVivo version 11 software for windows. The results of the entire analysis were presented by theuse of frequency distribution tables, pie charts, and graphs.The study found out that 77.65% of farmers were significantly affected by rainfall variation and 77.36% of farmers were significantly affected by temperature variation. It was found that 93.70% of respondents received trainingfrom Agricultural Extension Officers in the past one year with 90.26% of farmers attending at least one training. This study also established that all the farmers delivered their tea leaf to the factories with 64.76% of them being satisfied with the tea collection. It was also found out that 63.90% of the farmers felt that the amount of fertilizer available to them is adequate while 36.10% of farmers had inadequate fertilizer in their production. The study concluded that rainfall, temperature, pests and diseases, soil erosion, training and extension, services, fertilizers, labor and marketinfluenced thelevel of tea production in Nandi Hills Sub-County. The study recommended that extension services and support to the farmers from factories and other stakeholders should be enhanced. Researchers could usefindings and recommendations of this study to inquire more on tea production in Kenya. Also,the findings could aid academicians and tea farmers to understand more on ecological and social economic factors influencing tea production in Kenya.

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ACRONYMS AND ABBREVIATIONS

FAO	Food and Agricultural Organization.
KIPPRA	Kenya Institute ofPublic Research and Analysis.
KTDA	Kenya Tea Development Agency Limited.
TBK	Tea Board of Kenya.
TRFK	Tea Research Foundation of Kenya

OPERATIONAL DEFINITION OF TERMS

Education Level: This refers to the extent of formal school education and level of technical training by extension officers

Farm Inputs: This refers to tea farmers' affordable and the desired amount of weighted fertilizer for tea production.

Smallholder Tea Farmer: This refered to all tea growers who deliveredtheir produce to factories underKTDA.

Social Economic Factors: These are factors that directly impact farmerssocial patterns and income.

Tea Market: Refers to readily available and accessible locations where the farmercan deliver and sell own tea.

Tea Production: Means weighted tea produced by the smallholder tea farmers.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter covered the background, statement of the problem, objectives, specific objectives, research questions, thesignificanceof the study, the scope of the study and concludes with achapter summary.

1.1 Background of the Study

Kenya is predominantly an agricultural based economy with leading crops being tea, horticulture, cereals (wheat and maize), sugarcane and meat and dairy production are the key economic drivers in the livestock sector (Anon, 1994).Tea is an important cash crop in Kenya. At theindividual level, it generates cash income, and at thenational level, it generates the much needed foreign exchange and also provides employment. According to Kenya's Tea Directorate in the year 2017, Kenya is the main exporter of black tea globally. It has a projected output of about 412,000 metric tonnes. Data from the tea directorate show production so far in 2017 has gone down by a third compared to last year (Business Daily, Monday, October 2, 2017).

After production, smallholder farmers sell their tea through the largest tea agency in the globe which is Kenya Tea Development Agency. This agency has 62 factories. Thirty nine other factories are operated by farmers producing tea on large scale. From the small-scale farmers, tea produce is sold to collectors for processing rendering them price takers. These famers face the following challenges; low prices, linited agricultural extension services, markets and access to credit (Chan et al., 2010). They noted that due to rising number of smallholder producers,Kenya and Sri Lanka have become largest tea producers on the global.

Accoring to Tea Board of Kenya, (2009), 4% of Kenya’s Gross Domestic Product is ijected bt the Tea industry. This indusrty conributes 10% of Agricultural Gross Domestic Product making it pillar inactualizing the Vision 2030. Apart from being animportant agricultural sector, tea alsoearns Kenya high foreign exchange of up to 26% of the total

foreign exchange earnings (Tea Board of Kenya, 2010). On the same note, Gesimba et al. (2005) realized that this industry employs about 10 % of the Kenyan population.

Eastof the Rift Valley comprises tea grown around Mt. Kenya whilethe West of Rift Valley comprises of Kericho, Kisii and Nandi among others. In Nandi, the industry comprises of tea estates that produce purely for commercial purposes and the smallholder sector. Smallholder sectorcomprisesof individual farmers who have areas under tea averaging between 0.5 to 2 acres per household, apart from deriving cash income from the enterprise, a high percentage of the farmers do not produce tea purely for economic reasons but also to satisfy their cultural and social requirement (Bahemuka, 1987).

It is not a wonder therefore that smallholder owned farms are in various state of management standards partly because of these factors as well as lack of technical know-how. It is very common to find a well-managed farm next to a neglected one. There are smallholder farmers who look at tea as a status symbol and may grow it just to look like the neighbor without being prepared for its involvement regarding management required for optimum productivity.

Nandi Hills Sub-County has the potential for growing tea stands at 60,000 ha, but the total area currently under the crop is 14,050 ha, this represents 23.4% of the potential. The smallholder sector has a total of 27 million plants with an average yield of 0.7kg of produce per plant annually as opposed to the national average of 1.5kg of green leaf per bush per year in the sub-sector (Anon, 2003). The research achievement stands at 3.6 kilograms of green leaf per bush per year on average. The Kenya Tea Development Agency (KTDA) objective is to increase production in this sub-sector and attain a national average of 1.8 kg per bush per year and above. In Nandi Hills Sub-County this will only be realized if the constraints impeding production are established and suitable interventions developed to address them. The probable factors that seem to influence tea production in Nandi Hills Sub-County range from ecological to social, economic factors. This study hence endeavored to establish the influence of ecological and social economic factors on tea production in Nandi Hills Sub-County.

1.2 Statement of the Problem

Kenya is experiencing expansion in tea production despite of declined world tea prices and also overall tea consumption. Available statistics indicate Kenya is a country where tea expansiontrend has raiseddespite of environment of stagnating prices. Kenya exports 95% of its tea production andconsumes 5% (Tea Board of Kenya statistics, 2015). The tea market demand globally is lessthan the increased tea supply from the producer countries.The rateof tea production growth and consumption was anticipated toreduce from 2.2% to 1.2% over the period 2013 to 2017 (FAO, 2017). This was challenges related to tea production. They includedexhausted tea farms, poor tea quality, drought and chanes in climat, poor relationships between workers and employers, limited labour, expensive fam inputs, limited access to agricultural information, poor rain patterns, among others.

Few studies have been conducted on the socio-economic factors and none on theecologicalfactors that influence tea production inKenya by the smallholder tea farmer. Previous studies have studiedinfluence of policy factorson tea production in Kenya, leaving out other factors that mayinfluence tea production.Since tea erans Kenya a large foreign exchange and employsabout 10% ofits population, it warrants a research study on factors that affects its production. This study, therefore, sought to study the ecological and social economic factorsthat i9nfluence tea production by smallholder tea farmers in Nandi Hills Sub-county.

1.3 Objectives of the Study

The general objective of this study was to assess the influence of ecological and social economic factors on the level of tea production in Nandi Hills Sub-County.

1.3.1 Specific Objectives

This study adhered to the following specific objectives;

i) To determine the influence of ecological factors on the level of tea production in Nandi Hills Sub-County.

ii) To determine the influence of social factors on the level of tea production in Nandi Hills Sub-County.
iii) To determine the influence of economic factors on the level of tea production in Nandi Hills Sub-County.

1.4 Research Questions

This study sought to answer the following research questions;

i) To what extent doecological factors influence the level of tea production in Nandi Hills Sub-County?
ii) To what extent do social factors influence the level of tea production in Nandi Hills Sub-County?
iii) To what extent do economic factors influence the level of tea production in Nandi Hills Sub-County?

1.5 Significance of the Study

The findings of this study areepected to benefit the smallholder tea farmers in Nandi Hills Sub-County when making tea production decisions in the midst of declining World tea prices. The County policymakers and planners may use its findings to put in place ecological and social-economicmeasures necessary to lessen the declining global tea prices. The Kenya tea industry may also use the findings of this study to plan for adequate tea production volume in the Country. The findings and recommendations ofthis study may be used by the researcherstoinquire more on tea production in Kenya, as well as the academicians to understand more on ecological and social economic factors influencing tea production in Kenya.

1.6 Scope of the Study

The study concentrated onsmallholder tear producers from Nandi Hills Sub-County, Nandi County. The target population of this study was 5827 smallholder farmers who deliver their green tea leaves to the five tea factories in Nandi Hills Sub-County. The content scope was particularly to assess the influence of ecological and social economic

factors on the level of tea production in Nandi Hills Sub-County. Time scope of this study was from October 2017 to November 2017.

1.7 Chapter Summary

This chapter has covered the background information of the study by introducing the problem and after that stated the problem of the study. This chapter also gave the objectives that this study intended to meet as well as research questions the study sought to answer. The significance of the study and scope of the study were also discussed at length. The chapter concluded by giving a summary of all that was discussed in it.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter coverstheoretical literature review, empirical literature review, summary and research gaps, conceptual framework,operationalization of variables and concludes with a chapter summary.

2.1 Theoretical Literature Review

Cobweb model is an economic ideal that describes why prices might be subject to periodic variations in certain types of markets. It describes recurring supply and demand in a market where the quantity produced must be picked before prices are observed. Producers' anticipations about prices are presumed to be based on observations of previous prices. The cobweb model is grounded on a time lag amid supply and demand decisions. Agricultural markets are a context where the cobweb model might apply since there is a lag between planting and harvesting (Kaldor , 1934). Supposing that as a result of unpredictably ecological factors such as harsh weather , farmers collect smaller produce to the tea factories. This section focused on two models; Cobweb Model and Freire model of extension education. It also included their proponents and critiques.

2.1.1 Cobweb Model

The low production, a leftward shift in the market's supply curve, results in increased prices. Farmers expectingthe increased prices to persist, will then raise their production in the next year. This creates a surplus and prices decline. Farmers expecting declining pries to persist will limit their production in the next year resulting to deficit in demand which will then result into increased prices again.. As this situation reccursefully occurs between periods of defecit in supply, the price and quantity trace out a spiral. A spiral inward in demand causes a spiral putward in sumply causing an equelibrium.

Abridging, the cobweb model can have two main types of conclusions: If the supply curve is steeper than the demand curve, then the fluctuations decrease in magnitude with each cycle, so a plot of the prices and quantities over time would look like an inward

spiral. This spiral is known as the stable or convergent case. If the slope of the supply curve is less than the absolute value of the slope of the demand curve, then the fluctuations increase in magnitude with each cycle, so that prices and quantities spiral outwards. This spiral is known asthe unstable or divergent case. Two other possibilities are: Fluctuations may also remain of constant magnitude, so a plot of the outcomes would produce a simple rectangle if the supply and demand curves have the same slope (in absolute value). If the supply curve is less steep than the demand curve near the point where the two curves cross, butsteeperwhen we move sufficiently far away, then prices and quantities will spiral away from the equilibrium price but will not diverge indefinitely; instead, they may converge to a limit cycle.

As a proponent to the Cobweb Model, KIPPRA (2000)suggested the following measures that were embraced to enhance tea production in Kenya, which led to a pattern shift. In a liberalized economy, the TBK should control the industry, as outlined in the Tea Act (CAP 343), but licensing and marketing agencies should eliminated. This liberalization strategy was intended to stimulate increased tea production. 2). Tea Development Agency (KTDA) should play the role of marketing the tea from factory to the auction market as a commissioned management agent. This will maintain quality control and an incentive to reduce losses. KTDAexperiences poor operation systems, coordination and supervision of tea collection.

2.1.2 Freire Model of Extension Education

In his essay on extention,Paulo Freire applies philosophy of human consciousness into rural extension in Latin America. He uses agrarian reform to defferentiate "extension" from"communication," and how its is unmatchable with education. According to Freire, to educate is to humanize others through a conscious action to transform the world.He starts with a semantic expounding on the word "extension." Specifically he focuses on its use as extending something. The responsibility of the agricultural extension officer is to extendknowledge and technical capacities to farmers. Extension is different from improving a given situation in that it involves other people and their relationship with the world for the sake of changing the world. He states that those who extend do so from their understanding on the reality of the matter upon others.Freire disagrees with those

who argue that extension is educative. He discusses reasons for opposing new knowledge. He concentrates on the peasantcommunity and their culture. Adding another thought bring about anatural defensive reaction to mistrust and opposition. New and improved techniques and ideologies haveremarkableeffects on culture, including language and perceptions.

Therefore, according to Freire it is importance foragricultural extension officer to be knowledgeable and involved in the farmer's view but it could bea deeper cultural problem to the farmer. There may be a misleading information when an extension officerextends his/her own cultural perception to the farmer. Again thisraises the question of whether communication itself could infringeculture?And if considered as infringement, would Freire suggest forcing dialogue?Freire retorts to a critique concerning the impossibility of communication onscientific or technical information by asserting that the means of conversation are toinclude a confrontation of technical knowledge to their physical reality and its relation to theirlives. Concerningagrarian reform, Freire strainson the blend of technology and culture.He continues to say that agents of change are the technical trainers whopartake in associations with humanbeings and nature. He further stated that all development is modernization, not allmodernization is development".

A proponent of this model is Tea growers' handbook (1985), which is a compilation of the Tea Research Foundation of Kenya's (TRFK). The model proposes that, if a tea grower refers and practices what is endorsed therein, then production on tea would be maximized. The book has offered scientific solutions on to maximizingtea yields. However, it provides limited information on the social, economic and ecological equity on tea production.

2.2 Empirical Literature Review

This section is arranged according to the research objectives whereby this study reviews relevant literature on ecological and social-economic factors influencing the production of tea in Nandi Hills Sub-County.

2.2.1 Ecological Factors Influencing Tea Production

Ecological factors such as climate change, pests and diseases, and soil degradation are of interestin the production of tea. Change in climate is a global challenge facinghumanity. Since Kenya is also a vulnerable region, it also suffersfrom this challenge (Kiprono, 2015). Tea growing heavily relies on stable weather conditions. Hence effects of change in climate are atreat theto tea production. Some of the ecologicalfactors that affect the growth of tea growth are temperature, vapor pressure saturation, plant and soil water deficits (SWD) and rainfall and evaporation (Stephens et al., 1992).

Hail, frost, and drought are major effects of climate change whichto great extend influence tea production. The tea crop does well in area with annual rainfall of above 1200 mm, temperature ranging between 18^0C to 30 ^{0}C and soils that are well-drained.Drought spells are experienced in several areas in the country during which tea productiondrops by about 14-20%, and sometimes up to 30% during the severe droughts. Thisvaries as per the duration of the drought period and its intensity.For example, in Kenya in the year 2012, tea production dropped to 30 %. FAO (2015) reported that in Kericho, Nandi Hills and Sotik, hail caused a loss of 2.7 million kg of tea leaves. Favourable soil waterinfluence tea growth andconsequently the yields. Effect of climate change tothe production of tea includeincrease of air temperature which in turn affect growth cycles of tea plants. Consequently, harvest times and quality of products may change. Raising humidity intensities and evapotranspiration, lessen soil moisture and hence increased water stress on plants occasioninglower yields. Rainfall variationshas great influence on tea production. Majority of the Kenyan tea relies heavily on rain-fed farming, thus climate change coupled with the ever increasing rainfallinconsistency willdistress production. Climate change adaptation projects are being undertaken in the country on many socio-economic sectors including agriculture (Wahome, 2012).

Predicting climate change using global models for areas that grow tea has revealed that change in appropriate conditions for tea growing is site-specific (CIAT, 2011). The study also confirmed gradual increase in unsuitability for tea areas such as Nandi, Kericho and Gucha. This current study therefore established the influence of the climate change in Nandi Hills Sub-County six years after the above study. The climate change challenge

has also increased in burden owing to limited research available. Hence, dynamics of climate change are still poorly comprehended. Given this, this study aimed to establish the extent to which climate has affected tea production in Nandi Hills Sub-County. Thismay be of great benefit in future in making policies related to climate change mitigation to ensure that vulnerable tea producers. This will secure their future productions and make them more environmentally and economically sustainable. Changes in climate may also influence other ecological factors such as breeding of pests and diseases.

Tea plants are attacked by a variety of herbivores and the profile of pests vary from region to region. *Helopeltis theivora* and*Helopeltisshoutedeni* are serious pests of tea in Asia according to Sundararaju&Sundarababu (1999) causing 55% (Rattan, 1992) and up to 100% (Muraleedharan, 1992) crop loss. The *lepidopteran* pests, the tea tortricids, the bunch caterpillar and the loopers alsocause significant damage. *Homona* and *Adoxophyes* species attack tea in Sri Lanka. *Homonamagnanima*, on the other hand, is seen only in south Japan while *Homona coffearia* causes significant damage in India, Indonesia, and Sri Lanka with 50 percent yield loss reported in Sri Lanka (Cranham, 1996). The tea looper *Buzura suppressaria* is at present very serious in India. The shot hole borer *Xyleborusfornicatus* is a major pest in Sri Lanka causing up to 100% damage in mid-countryas well as the dry zones. Mites are highly persistent pests and are known to cause serious damage to tea plants. The red spider mite *Oligonychuscoffee* causes serious damage in India, Sri Lanka, Bangladesh, Taiwan, Malawi, Uganda, Zimbabwe and Kenya (Gotoh and Nagata, 2001; Han, 2000). *Helopeltistheivora* and *Helopeltisshoutedeni* are serious pests of tea in Kenya (Rattan, 1992). This study hence sought to determine how pests and diseases affect tea production in Nandi hills.Over-reliance on chemical pesticides for the management of these pests has led to soil degradation and hence affecting tea production.

Tea is grown in areas experiencing plenty rainfall throughout the year. This rains accelerates growth of weeds. New tea plants are planted at a positioning of 120 cm by 60 cm exposing much soil surfaceto sunlight. This situation lasts for lengthy period and is very encouraging for weed growth prior to canopy closing. The plants are pruned of their

foliage after every 3-4 years to increase productivity. The practice creates open groundfor weed growth until there is re-growth of foliage. The common method of weeding in tea plantations was scraping the weeds off the surface of the soil. This practice aggravates the erosion problem because it leaves behind a layer of loose soil which is easily washed away by rainfall(Krishnarajah, 2005).

An important environmental problem is the degradation of land particularly soil erosion. It causes on-site effects such as loss of output or decline of productivity leading to a decreased farm produce. Stagnated tea yields in most areas can be explained by the diminishing fertility due to soil erosion. Unabated soil erosion will bring not only further decline in productivity, but also threaten the sustainability of any form of agriculture on these lands (Ananda, 1998).

According to Ekanayake (2004), manualweeding using scrapers resulted in severe soil loss of about 30cm of topsoilper hectare eroding over a century in Sri Lanka which translated into soil erosion of 40mt/ha/yr.In his research, Chambers (2003) demonstrated that losses from erosion could be countered by use of herbicides instead of manual scraping. A research in China hasshown erosion reductions up to 80% when herbicides are used instead oftillage in tea fields.Herbicides have extensivelybeen used toterminate weeds infresh clearings and pruned tea fields. The above studies failed to establish a link between these ecological factors and tea production. Therefore this study aimed at closing this gap by establishing the influence of ecological factors on tea production in Nandi Hills Sub-County.

2.2.2 Social Factors Affecting Tea Production

Tea production is affected by social factors such as extension services and education to farmers. A study by Owour, Kavoi and Siele (2002) found that the extension staff recognized the need to have extension courses for the farmers. Their study on how extension staff supposed policies swaying tea production and extension activities concluded that the staffs'administration of regular courses to the extension staff could impact farming. The staffs were to offer the education received to the farmers. With regard to philosophy of human consciousness into the domain of rural extension in Latin America, Freire (1973), the extension agent are construed to extending their knowledge

and technical capacities. This study will seek to find out if farmers in Nandi Hills Sub-County are given tea related training. It is also imperative to find out whether there exists a training program for the farmers. The scholars also observed that in the smallholder tea farming, production is heavily dependent on technologies reaching the farmers, especially the farm inputs.

On the extension policy, Owour*et al.* (2002) claim that user-friendly policy is a pre-requisite for ease of adoption. Occurrences where policies tend to be despoticare weakly accepted or face rejection. This study sought to find how the technologies get down to the farmers and how they influence tea production. Their study also established that majority of the tea extension staff suggested need to restructure the extension organization so that it is both staff and farmer friendly.

Since the tea sector was liberalized in the 1990s, smallholder farmers have been lacking information on better methods. When the government used to control the tea farming sector, extension services (including information on better tea farming practices) from the Ministry of Agriculture were availed to farmers. It is After liberalization, farmers were required to pay for these services, where many were either unable to pay, or they are ignorant about their usefulness. Tea Research Foundation of Kenya has developed 45 varieties of tea as noted earlier but many farmers are yet to adopt them due to lack of information about their availability (Kagira, Kimani&Githii, 2012).

Information flow is poor and at times lacking, especially that relating to pricing as CPDA(2008) elaborates. Also, farmers at the bottom of the pyramid are the most disadvantaged, as they receive little information and their feedback hardly reaches the top; and when it gets there it is misrepresented. Small holder farmers also are unskilled in general farm management practices. A study by Mwaura and Muku (2007) found that this sector had diverse experience in tea farming that ranged from one year to fifty years thus affected productivity. It was also further noted that some tea farmers did not use any fertilizer on their farms, while others applied more than the appropriate amount of 150kg of nitrogen per hectare per year. High operational costswere also experienced as a result of poor supervision of tea pluckers and other farmlabourers. This study hence intended to establish whether theextension services influence tea production.

2.2.3 Economic Factors Affecting Tea Production

A study on extension service knowledge and farm adoption levels by Owour, Kavio, and Siele, (2001), postulated that fertilizer application was one technology which ensured farmers get higher production. This study sought to find out how this farm input affects tea production. Also answer the question as to wheter farmers rely on fertilizers alone for their tea production. It was similarly interesting to evaluate whether this fertilizer is readily available and in quantities required by the farmers. Tea Handbook, (1985) contends that if a farmer uses fertilizer and harvest tea at regular intervals, yields are likely to increase. This study intended to investigate how this key farm input, namely fertilizer influence tea production by smallholder tea farmer in Nandi Hills Sub-County.

In 2005, world tea market projections indicated increased imbalance on tea supply and demanded to tend to 98 000 tonnes. World black tea consumption growth rate was anticipated to drop from 2.2% over the period 1993-2003 to 1.2% over the next period 2003 to 2014. The major reason was the slowdown in consumption in producing countries, since production growth had rate beaten the growth in demand for exports (FAO, Intergovernmental group on tea, 2005). The available information indicates that Kenya Tea Development Agency Limited (KTDA) is accountable for leaf collection, processing and marketing on behalf of the smallholder tea farmers. This study aimed to find out how the market and marketing impact tea production by the smallholder tea farmer in Nandi Hills Sub-County.

In Kenya, tea consumption for the year 2011 stood at 20 000 tonnes out of the total production of 377 900 tonnes (Tea Board of Kenya Statistics). This is significantly dissimilar to India, because out of 960,000 tonnes produced annually, and local tea comsumed accounts for about 805,700 tonnes. It is clear that Kenya relies majorly on the world tea market. The availableinformationindicated that Kenya’s tea production was on upward trend (Tea Board of Kenya, 2012). Currently, Kenya is the major exporter of black tea globally and the projected output on 2017 was 412,000 metric tonnes according to Kenya's Tea Directorate. Latest data from the tea directorate show production so far in 2017 has gone down by a third compared to last

Kenya, being a chief tea exporter and therefore susceptible to world price variations, should be alert to global concerns. Food and Agricultural Organization (2005) notedthough in 2014 the quantity of black tea consuption in producing countries was expected to grow by 1.3 percent per year to reach 1.33 million tonnes, producer countries are projected to consume only 49 percent in 2014, acceleratingthe demand and supply imbalance.

About half of the increase in world black tea originated in Africa, where production was likely to continue growing while domestic consumption remained low. It will be remembered that while the global community is an easy with low tea prices, Kenya is equally not contented with its reduced tea prices in the middle of increasing costs of production such as labour.

The industry is labourintensive according to Bandara, (1996). Due to these characteristic, there is no doubt that the labour is an important factor affecting productivity of tea plantation. Therefore, availability and productivity of labouris highly correlated with the total productivity of tea. However, labour productivity recorded in tea plantations is low compared to competitive labour markets both domestic and foreign. It has been reducing significantly over the past few decades. In Sri Lankan estate workers ranked at the bottom of the international productivity tables. According to a study in Kenya by Waweru (2012) 86.1% of the farmers engage labour on their farms. Very few farmers do not involvelabour. Those who did not respond may be using familylabour which they could not consider as hired labour. All the farmers were found to use labour on their farms. This study hence aimed to find out whether labour is available, ability to pay for the engaged labour and this affects tea production in Nandi Hills Sub-County.

2.3 Summary and Research Gaps

In the literature reviewed mixed results are obtained by different researchers in different area using different methodologies. Stephens et al. (1992) listed ecological variables expected to affect the growth of tea shoots. They comprised temperature, vapour pressure saturation, plant and soil water deficits (SWD) and rainfall and evaporation. In his study he failed to show how the ecological variables influences the level of tea production on small holder tea farmers which is the focus of this current study. A research in Kericho, Sotik and Nandi Hills by FAO (2015) concentrating on the net loss of green leaves due to hail, estimated a net loss of 2.7 million kg per annum. The above study only focused oflarge scale plantations but did not factor in small holder farmers.

Wahome (2012) did a climate change adaptationproject in the country on many socio-economic sectors includingagriculture but he did not establish a link between climatic changes and level of tea production which is a focus of this current study. CIAT (2011) used predictive modeling on climate change in areas that grow tea.It discovered that change in suitable conditions for tea growing is site-specific. The study also noted that some areas had gradually become unsuitable for tea. This study seeks to find out the exact situation six years after the above research by CIAT (2011). Various researchers such as Sundararaju and Sundarababu (1999), Rattan (1992), Muraleedharan (1992), Cranham (1996), Han (2000), and Gotoh and Nagata (2001) have found that tea plants are attacked by a variety of herbivores and pests that vary from region to region causing 55% and up to 100% crop loss. All this studies were done outside Kenya which opens a research gap for this current study.Research by Chambers (2003),Ekanayake (2004), Krishnarajah (2005) found out that the practice of weeding with scrapers aggravates the erosion problem because it leaves behind a layer of loose soil which is easily washed away by rainfall. These studies did not establish the influence of the soil erosion on the level of tea production.

A study by Owour, Kavoi and Siele (2002) found that the extension officers found it worth to have extension services to the farmers. Kagira, Kimani and Githii, (2012) found out that Tea Research Foundation of Kenya had brought into existennce 45 varieties of tea. However, many farmers weer yet to adopt them as a result of limited no information

about their availability. Mwaura and Muku (2007) in their study found out that small scale tea farmers had diverse experience in tea farming that ranged from one year to fifty years. Furthe findings showed that tea farmers failed to use any fertilizer on their farms, while others applied more that required quantity of 150kg of nitrogen per hectare per year. Up to date, there problem of lack of know-how among farmers still persists and therefore this study attempts to bridge this research gap. Again, their research did not establish a link on how this lack of information influences the level of tea production.

CPDA (2008), showed concern on the poor flow of information which at times at times lacking, especially that constituting pricing.A study on extension service knowledge and adoption levels Owour, Kavio and Siele, (2001), postulated that fertilizer application was one technology which ensured farmers get higher production.The Tea Handbook, (1985) contends that if a farmer uses fertilizer and harvest tea at regular intervals, yields are likely to increase. Small holder farmers still face the challenge of affordability of the fertilizers and therefore this study endevouredto establish how fertilizer application influences the level of tea production a gap left out by the above study.

According to Bandara (2006), tea industry is the most labour intensive of the plantation industries. Also a study in Kenya by Waweru (2012) indicates that 86.1% of the farmers engage labour on their farms. Very few farmers do not involvelabour. The 13% who never responded may be using family labour which they could not consider as hired labour. All the farmers were found to use labour on their farms. However, his did not establish how labour influences production level of tea which was a focus of this current study.

FAO through Intergovernmental group on tea (2015) affirmed thatblack tea consumption growth rate in world was expected to reduce from 2.2% over the period 2003-2014to 1.2% over the next period 2015 to 2017. Major reason being theconsumptionslow-downin producer countries, as the production growth rate outpaced demand for exports. Their study failed to show how the changes in demand for exports affects the level of tea production in Kenya. According to Business Daily, Monday, October 2, 2017 production of tea in 2017 went down by a third paralleled to last year. It is in the interest of this study to establish whether economic factors cause this decline in tea production.

2.4 Conceptual Framework

The independent variables of this research work were the three factors affecting tea production in Nandi Hills Sub-County, namely; Ecological, Social and Economic factors. These variables were analyzedabout tea production which is the dependent variable. Ecological factors were measuredregarding climate change, pests and diseases, and soil degradation. Social factors were measured regarding agricultural extension services and training as explained by Freire model of extension education. Economic factors were measuredregarding farm inputs (fertilizers, pesticides and herbicides), labour and market as explained by Cobweb Model. The dependent variable of this study, tea production, was measured in terms of weighted green leaves at collection points.

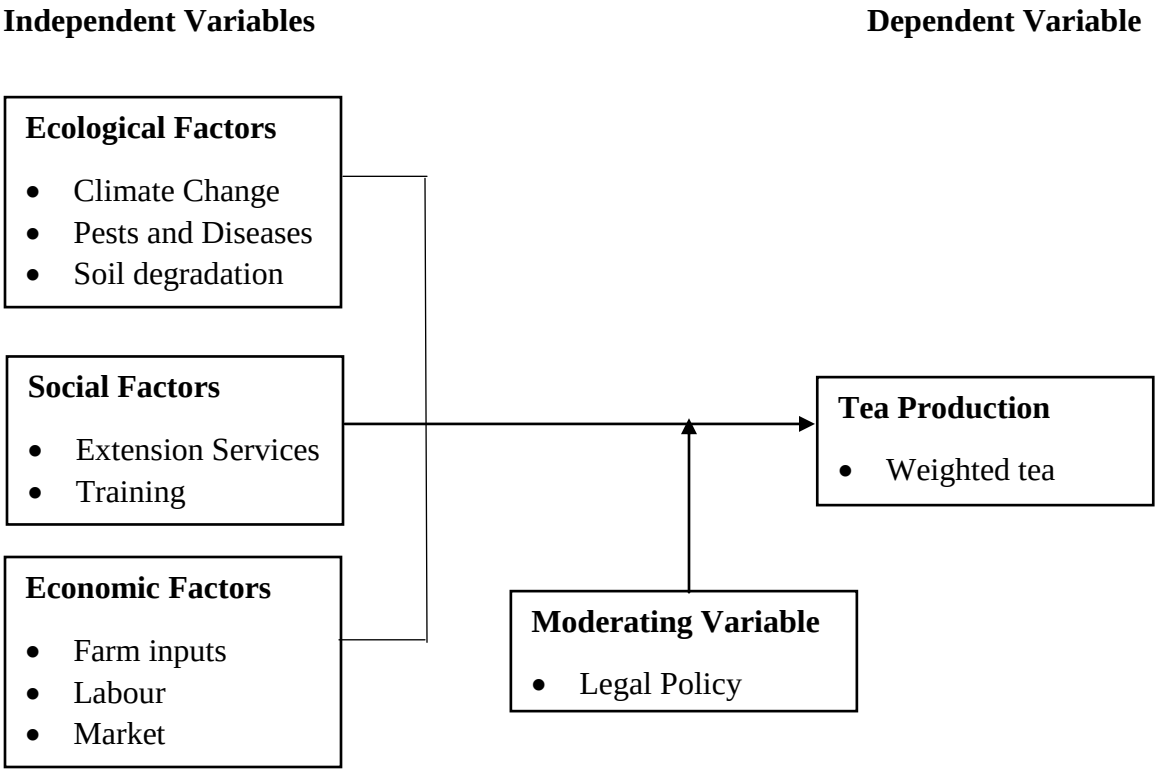

Figure 2.1: Framework showing the relationship between ecological and social economic factors and tea production.

Source:Own Conceptualization(2017)

2.5 Operationalization of Variables

Ecological factors: They will be measured in terms of climatic change, pests and diseases and soil degradation.

Social factors: They will be measured in terms of extension services and training offered to farmers

Economic factors: These will be farm inputs, labour and market availability for produce

Tea production: the is the weighted tea produced

2.6 Chapter Summary

Literaturereview was discussed at global and local level. Smallholder tea farmesr found to be unhappy with the low tea prices. However, they havecontinuedproducing tea. The literature also revisited existing researches by earlier scholars and identified gap on ecological and social economic factors influencing tea production in Kenya. Very little research work has been done on ecological and social economic factors influencing tea production. Therefore, three research variables were developed in the course of literature review to guide this study. The three main variables, namely ecological factors, social factors and economic factors were discussed. Legal and policy framework as contained in the Tea Act and KTDA Order Paper werestressed as moderating variable. A conceptual framework was lastly developed to help answer the three research questions.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter covers the research design, target population, sample and sampling techniques, instruments, pilot study, data collection procedure, data analysis and presentation, ethical considerations and concludes with a chapter summary.

3.1 Research Design

The descriptive survey design wasadopted for this study. Kumar, (2011) explains a descriptive study as one that attempts to describe systematically a situation, a problem, phenomenon, service or programme or provides information about the living condition of a community, or describes anattitude towards an issue, values, and characteristics. According to Wiersma (1995), the selected design is suitable for collecting information related to phenomena under study and then, conclusions are reached from the facts discovered. The descriptive survey design gives the researcher a lot of information gotten even from a large sample of respondents (Fraenkel and Wallen, 2009). Using this design, the researcher was able to obtain information on the ecological and social economic factors influencing tea production in Nandi Hills Sub-County.

3.2 Target Population

The target population composed of5,827 the tea farmers in Nandi Hills Sub-county. The accessible population will be3729smallholder tea farmers delivering green leaf to all the tea factory clusters in Nandi Hills Sub-County. The choice of the smallholder tea farmerswas based on the fact that they more affected by ecological, social and economic factors than large-scale farmers which were one of the criteria for inclusion in the study. According to KTDA data in the year 2015, smallholder farmers comprised 64% of total tea farmers in Nandi Hills Sub-county which helped in meeting the required sample size.

Table 3.1: Target population

Factory	Smallholders Tea Farmers
Chebarus	422
Chematich	926
Chemomi	864
Kaplelmet	828
Taito	689
Total	**3729**

Source (KTDA, 2017)

3.3 Sample and Sampling Technique

This study used a stratified random sampling technique to select smallholder farmers to be study respondents. In this technique, the population issubdivided into homogenous strata and then simple random sampling applied oneach stratum (Albright, Winston, & Zappe, 2010). Proportionate stratified random sampling is used when the size of the sample taken from each stratum is proportionate to the percentage that each stratum is within the population (Black, 2012). The technique enables the researcher to take into account the population's different subgroups and guarantees that the sample accurately represents the population on specific characteristics (Jackson, 2014). The advantage of stratified random sampling is that it ensures unbiased inclusion of the sample subgroups.

To identify participants for the study, names will be systematically picked from registers held by tea collection factories. Tea growers were grouped based on the factories buying their tea. These factories comprisedChebarus, Chematich, Kaplelmet, Chemomi and Taito. The number of respondents in each group will be determined based on the proportion (10%) to the total number of smallholder farmers supplying their green leaf to estate tea factories within the district. Researchers have used and appreciated the use of 10% of a population for inclusion as sample size (Jagero, 2015). Farm household is considered an appropriate unit for analysis because decisions on allocation of land, labour and other farm activities among the Nandi community are done at household level with the household head as the ultimate decision maker.

A sample size of 375small holder farmers was randomly picked from a target population of about 3729 smallholder teafarmers in Nandi hills. At least40 farmers was picked from each factory groupwhich wasadequate to capture any variability in the data set while at the sametime, allowed data manageabilityin terms of cost and logistics. Thedistribution of each factory group is as shown in Table 3.2.

Table 3.2: Sample Size Distribution

Factory	Smallholders Tea Farmers	Sample proportion
Chebarus	422	43
Chematich	926	93
Chemomi	864	87
Kaplelmet	828	83
Taito	689	69
Total	**3729**	**375**

Source: KTDA(2017)

In addition, 10 agricultural extension officers were selected to inform the study as key informants.

3.4 Research Instruments

The study used farmer questionnaires and interviews for agricultural extension officers to obtain primary data for the study. According to Wierma (2008), questionnaires are reliable instrument of data collection and many a times are applied to gather information about attitude, behaviour, activities and responses to events within a limited time. Kiess, and Bloomquist (2005) adds that this measuring tool is also easy to administer. The questionnaires consisted ofclosed ended questions, Likert scale and open-ended questions. Closed-endedquestions and Likert scale yielded quantitative data while open-ended questions yielded qualitative data, which provided an in-depth insight to ecological and social economic factors influencing tea production in Nandi Hills Sub-County. Interviews with key informants of this study, that is, agricultural extension officers

provided more accurate information to this study because they are expected to have reliable facts on ecological factors affecting tea growing.

3.5 Pilot study

The study pilot study comprised of validity and reliability test. It was carried out to ensure that the research instruments could be relied upon when used over a period.

3.5.1 Validity

According to Kothari (2004), validity refers to the extent to which research instruments measure what it is intended to measure. This means that, the closer a quantified comes to reflecting the definition of the underlying concept the research is concerned, the more valid it is. According to Fawcett (2013), a valid test succeeds in measuring what it intended. To ensure face and content validity, the researcher consulted the study supervisor. The supervisor assessed and provided feedback on the corrections required. Supervisor's participationwas used to improve vagueness in questions, biases and wrong wordings.

3.5.2 Reliability Test

Reliability refers to the extent to which a research instrument gives measures that are consistent each time it is used to the same individuals (Jackson, 2011). Test and re-test method wasadopted to measure the consistency of the study questionnaires based on a pilot study carried out by administering the questionnaires twice to the same group of farmers not selected in the sample. The subsequent questionnaire administering was done after two weeks to asses whether the resultswere the same. According to Kline (2013) a test-retest reliability of a test is to be measured through correlating scores respondents on two occasions. Correlationcoefficient of the results from the two tests was calculated using spearman rank correlation. According to Mugenda and Mugenda (1999), a positive coefficient of 0.7 and above confirms reliability of a measuring tool. The correlation coefficient of the results from pilot study was 0.891. This confirmed that the questionnaires were reliable in measuring ecological, social and economic factors influencing the level of tea production.

3.6 Data Collection Procedure

Before the actual data collection, authority to collect research datawas obtained from The Management University of Africa, through the School of Development Studies. Thereafter, Nandi hills Sub-county officewas informed of the proposed research and request for clearance. The researcher also visited the selected factories for anintroduction where she sought clearance for the research by the factory authorities. She also requested for register of small holder tea farmers who supply them with green tea leaves, made appointments for data collection and sought their cooperation. The researcher returned to the factories on the agreed and scheduled dates for data collection. Names of allparticipants in the study were kept confidential.

3.7 Data Analysis and Presentation

After data collection, the responses weretabularized, coded and then entered in preparation for analysis. Statistical package for social sciences (SPSS) version 22was used. Matin and Acuna (2002) say the software can analyze complex data collected from the field. Since the study yielded both quantitative data and qualitative data, descriptive statistics and inferential statistics were used. The study applied descriptive statistics such as frequencies, and percentages. Qualitative data especially from the interviewswas reported in verbatim, transcribed and coded according to various themes, categories and sub-categories as per objectives as they emerge during the study using NVivo version 11 software for windows. According to Creswell (2014) explains that qualitative data reinforces the quantitative data on the opinions of the participants. The results of the entire analysis were presented by theuse of frequency distribution tables.

3.8 Ethical Considerations

All researchers in any research have the responsibility to protect the well-being and the dignity of the people they are investigating during thestudy.

3.8.1 Informed Consent

The respondents' consent was sought and were informed of the aim of the study. The researcher ensured that the purpose of the study was thoroughly explained in time to the respondents.

3.8.2 Voluntary Participation

Respondents were informed that participation is out of free will and that they could omit answers to any particular questions if they choose to.

3.8.3 Confidentiality

Confidentiality was maintained all the times. The respondents were not required to fill their name or any other form of identification anywhere in this research work.

3.8.4 Privacy

Adequate measures were taken to protect the privacy of the respondents whichhelped them feel at home to express their opinions about the research questions.

3.8.5 Anonymity

The anonymity of the identity of respondents was observed all the times.

3.9 Chapter Summary

The research reviewed various methodologies, and a descriptive research design method was adopted as appropriate for this study. The study target a population was 5827 smallholder tea farmers. A representative sample size of 385 respondents was selected using stratified random sampling, as explained by Mugenda, 1999 and purposive sampling. Data collection was through questionnaires and interview schedules. The validity and reliability of the questionnairewas ensured to minimize errors during data collection. The desired inquiries, based on the variables of study, were to understand and describe the ecological and social economic factors influencing tea production by the smallholder tea farmer in Nandi Hills Sub-County. Data collection and analysis procedures such as sorting, cleaning, editing, and codingwere done.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.0 Introduction

This chapter presents the summary of the analyzed data. The results are presented based on the objectives of the study, which was aimed at assessing the influence of ecological and social economic factors on the level of tea production in Nandi Hills Sub-County. To put the results of the study into perspective, the findings were organizedinto the following categories; farmers' education level, climate change, pests and diseases, soil degradation, extension services, training, farm inputs, labour, market and weighted tea production. The data wereanalyzed using both descriptive and inferential statistics by use of Statistical Package for Social Sciences software (SPSS). The data analyzed is tabulated using frequencies and percentages.

4.1 Presentation of Research Findings

This section presents questionnaire response rate, demographic data of farmers and ecological, social and economic factors influencing the level of tea production.

4.1.1 Questionnaire return rate

Table 4.1: Questionnaire Return Rate

Sample	Returned Questionnaires	Percentage
375	349	93.07%

Source: Field Data Analysis, (2017)

Table 4.1present data on the questionnaires duly filled and returned by the respondents. Out of the 375 questionnaires distributed to the respondents, 349 of them were correctly filled and returned. This indicates that 26 questionnaires were not duly filled and returned by the respondents which represents 6.93% of total questionnaires issued. Thus the return rate was 93.07% which improved thereliability of the findings and made the research a true representative of the target population.

4.1.2 Demographic Information

Demographic information obtained in this study included gender, age and factory of green tea leaves delivery.

Table 4.2: Demographic Information

	Frequency	Percent
GENDER		
Male	199	57.02
Female	150	42.98
Total	**349**	**100.00**
AGE GROUP		
18-27 Years	49	14.04
28-37 Years	141	40.40
38-47 Years	87	24.93
Above 47 Years	72	20.63
Total	**349**	**100.00**
FACTORY		
Chebarus	39	11.17
Chematich	86	24.64
Chemomi	81	23.21
Kaplelmet	78	22.35
Taito	65	18.63
Total	**349**	**100.0**

Source (Field Data Analysis, 2017)

Table 4.2 indicates that among the respondents, 57.02% were male and 42.98% female. Majority (40.40%) of farmers were in the age bracket of 28-37 years while 24.93% were between 38-47 years. Only a few farmers were between 18-27 years and above 47 years comprising 14.04% and 20.63% respectively. The results further showed that Chematich tea factory produced highest (24.64%) number of respondents while Chebarus produced

the least (11.17%). This may be due to factory size whereby Chematich is the largest tea factory in Nandi Hills Sub-County.

4.1.3 Ecological factors influencing the level of tea production

This study established three ecological factors influencing the level of tea production in Nandi Hills Sub-County, these are, climate change, pests and diseases and soil degradation

Table 4.3: Effect OfRainfall Variation On Crop

Rainfall Variation	Frequency	Percent
Not at all	12	3.44
Very Little	23	6.59
Little	43	12.32
Somewhat	79	22.64
Great extent	192	55.01
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

According to Table 4.3, 77.65% of farmers cited that their crops were significantly affected by rainfall variation while 18.91% were cited that rainfall variation did not significantly affect their crops. Only 3.44% cited that rainfall variation did not affect their crops at all. This is probably because they carried out irrigation and or were adjacent to a river.

Table 4.4: Effect OfTemperature Variation On Crop

Temperature Variation	Frequency	Percent
Not at all	7	2.01
Very Little	28	8.02
Little	44	12.61
Somewhat	81	23.21
Great extent	189	54.15
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.4 shows 77.36% of farmers cited that their crops were significantly affected by temperature variation while 20.63% were cited that temperature variation did not significantly affect their crops. Only 2.01% cited that temperature variation did not affect their crops at all.

Table 4.5:Pests AndDiseases Invasion On Crop

Pests and Diseases	**Frequency**	**Percent**
Never	49	14.04
Rarely	51	14.61
Sometimes	62	17.76
Usually	154	44.13
Always	33	9.46
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.5 indicates that 53.59% of respondents were severally affected by invasion of pests and diseases with 32.37% farmers being affected by the same on fewer occasions. The study also shows that 14.04% were never affected by the invasion of pests and diseases. The latter may be due to heavy spraying of pesticides and also use of improved technology in pestand disease control.

Table 4.6: Soil Erosion Occurrence On Farm

Soil erosion	**Frequency**	**Percent**
Never	150	42.98
Rarely	162	46.42
Sometimes	24	6.88
Usually	11	3.15
Always	2	0.57
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.5 indicates that only 3.72% of respondents were severally affected by soil erosion with themajority (53.30%) of farmers being affected by the soil erosion on fewer occasions. The study also shows that 42.98% of farmers were never affected by the soil erosion. The latter may be due to better farming methods and practices in their farms.

4.1.3 Social factors influencing thelevel of tea production

This study established how training and extension services influence the level of tea production in Nandi Hills Sub-County.

Table 4.7:Tea Farmers Training By Agricultural Extension

Training	Frequency	Percent
Yes	327	93.70
No	22	6.30
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.7 shows that 93.70% of respondents were trained by the Extension Officers in the past one year. This indicates that a high group of farmers had received extension training from Agricultural Officers to enable them to carry on with tea production activities. This may have helped them to raise their tea productivity.Table 4.8 shows the number of times of tea production training sessions that were conducted by Agricultural Extension Officers.

Table 4.8:Number Of Times Tea Farmers Trained On Tea Production Last Year

Training	Frequency	Percent
None	22	6.30
Once	56	16.05
Twice	113	32.38
Thrice	109	31.23
More than thrice	49	14.04
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.8 shows that 77.65% of the tea farmers had attended at least two training while 90.26% hadat least one training. A high number of growers attending training sessions could have resultedin increased tea productivity by the farmers. 9.74% farmers, had not been trained on tea production.The respondents were asked to rate the number of training sessions offered by extension officers whose results are shown in Table 4.9.

Table 4.9:The Rating Of The Number Of Annual Training To Tea Farmer

Rating	Frequency	Percent
Not enough	162	46.42
Enough	173	49.57
More than enough	8	2.29
Excessively many	6	1.72
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.9 indicates that 49.57% of the farmers felt that the number of annual trainingwas enough and 46.42% farmers were of the opinion that the number of sessions was not enough. On the other hand, 2.29% and 1.72 cited that the number of training was more than enough and excessively many respectively. This high demand for more training could be an indication that tea farmers valued thetrainingabout increased tea production.

4.1.3 Economic factors influencing the level of tea production

This study establishes three economic factors influencing the level of tea production in Nandi Hills Sub-County, these are, farm inputs (such as fertilizers), labor and tea market.

Table 4.10:Tea Farmers Application Of Fertilizers

Application	Frequency	Percent
Yes	332	95.13
No	17	4.87
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.10 indicates that 95.13% of the farmers applied fertilizer to their tea. A high number of farmers use fertilizer in their tea production. This high use of fertilizer by the

farmers may have contributed to the increased tea production. Tea plants normally do well when soil nutrient is high according to Tea Research Foundation of Kenya (2016). The farmers were further asked whether the applied fertilizers were adequate for tea growing on their farms. Table 4.11 presents the results.

Table 4.11:Distribution Of Tea Farmers Response To Amount Of Fertilizer Adequacy

Adequate	Frequency	Percent
Yes	223	63.90
No	126	36.10
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.11 portrays that majority (63.90%) of the farmers felt that the amount of fertilizer available to them is adequate. Few farmers expressed that the fertilizer available to them was not enough. The 36.10% farmers that felt the fertilizer was not adequate could require further investigation to establish the reasons why, as themajority of the farmers were found to use fertilizer.All the farmersconfirmed to use labor on their farms either employed or labor from family members as shown in Table 4.12.

Table 4.12:Distribution Of The Number Of Pluckers Engaged Monthly

Pluckers	Frequency	Percent
1-7 workers	298	85.38
8-14 workers	47	13.47
15 and above workers	4	1.15
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.12 indicates that 85.38% of the farmers engage labourof 1-7 workers on their farms. Fewer farmers (13.47%) of farmers engaged labour of 8-14 workers on their farms. Very few farmers (1.15%) engage labour of more than 14 workers. It was clear from this study that tea growing was labour intensive as all farmers used labour on their farms. The farmers were further asked whether the labour they engaged was adequate. Their responses were as tabulated in Table 4.13.

Table 4.13: LabourAdequacy

Adequate	Frequency	Percent
Yes	279	79.94
No	70	20.06
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.13 shows that 79.94% of the tea farmers felt that the labour they got to pluck tea was adequate. The 20.06% of farmers who felt that labor they got was not enough, may have suffered during high crop harvest.This study established that all the farmers collected their tea leaf to the factories. This was a motivation to continue increasing production and delivering tea.However, the level of satisfaction with their green tea leaf collection was different among the farmers.

Table 4.14:Levels Of Satisfaction With Green Leaf Collection By The Factory

Satisfaction	Frequency	Percent
Extremely dissatisfied	15	4.30
Dissatisfied	89	25.50
Neutral	19	5.44
Satisfied	177	50.72
Extremely satisfied	49	14.04
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.14 shows that 64.76% of the farmers are satisfied with tea collection, with a good number, 29.80% being dissatisfied with collection services. The latter group requiresbeing investigated to establish why such a large number of growers were unsatisfied with their tea collection.

4.1.4 Level of tea production

Quantities of tea leaf delivered to the factory by each farmer for the last one year is as presented in Table 4.15.

Table 4.15:Tea Delivered To The Factory Last Year

Quantity	Frequency	Percent
100-1500 kgs	99	28.37
1600-3000 kgs	97	27.79
3100-4500 kgs	63	18.05
4600-6000 kgs	49	14.04
6100-7500 kgs	21	6.02
7600-9000 kgs	16	4.58
9100-10500 kgs	4	1.15
Total	**349**	**100.00**

Source (Field Data Analysis, 2017)

Table 4.15 shows that majority (56.16%) of farmers delivered at most 3000kgs last year. Only 5.73% of farmers delivered green tea leaf of above 7500kgs.

4.2 Limitation of the Study

Some of the challenges encountered while conducting the study were that the respondents were too busy delivering tea leaves at the factories. The researcher overcame this by booking an appointment with the respondents and giving them enough time to fill the questionnaires.

4.3 Chapter Summary

The questionnaires return rate was 93.07%. Data from these questionnaires were analyzed using Statistical Package for Social Sciences. The analyzed data was then tabulated using frequencies and percentages. It was finally interpreted and discussed as per the research objectives.

CHAPTER FIVE
SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

5.0 Introduction

This chapter contains the summary of findings, recommendations, and conclusion.

5.1 Summary of Findings

This study established three ecological factors influencing the level of tea production in Nandi Hills Sub-County; climate change, pests and diseases and soil degradation. The study found out that majority (77.65%) of farmers were significantly affected by rainfall variation on their tea farms. Also 77.36% of farmers were significantly affected by temperature variation in equal measure. This study further found out that 53.59% of respondents were severally affected by invasion of pests and diseases with 32.37% farmers being affected by the same on fewer occasions. However, it was established that majority (53.30%) of farmers were affected by the soil erosion on fewer occasions and 42.98% of farmers were never affected by the soil erosion.

The studyestablished that training and extension services influenced the level of tea production in Nandi Hills Sub-County. It was found that 93.70% of respondents were trained by the Agricultural Extension Officers in the past one year with 90.26% of farmers attending at least one training. This study also found out that 49.57% of the farmers felt that the number of annual trainingwas enough while 46.42% farmers were of the opinion that the number of sessions was not enough.

This study established three economic factors influencing the level of tea production in Nandi Hills Sub-County; farm inputs (such as fertilizers), labour and tea market. In this regard, 95.13% of the farmers were found to have applied fertilizer to their tea. It was also found out that majority (63.90%) of the farmers felt that the amount of fertilizer available to them is adequate while 36.10% of farmers felt the fertilizer was not adequate. Again, all the farmers were found to use labour on their farms either employed or labour from family members with 85.38% of the farmers engaginglabour of 1-7 workers on their

farms. Further investigation found out that 79.94% of the tea farmers felt that the labour they got to pluck tea was adequate. This study established that all the farmers delivered their tea leaf to the factories with 64.76% of them being satisfied with the tea collectionand 29.80% being dissatisfied with the collection services.

5.2 Conclusion

Given the findings of this research study, several conclusions were made. The conclusions are in line with the research objectives and findings of the study.

This study concluded that majority of farmers were significantly affected by rainfall and temperature variation. This study further concluded that respondents were severally affected by invasion of pests and diseases. However, it was also concluded that majority of farmers were affected by the soil erosion on fewer occasions.

The study concluded that majority of respondents were trained by the Agricultural Extension Officers in the past one year whereby most of them attended at least one training session. This study also concluded most of the farmers felt that the number of annual trainingswere enough.

The study also concluded that majority of farmers applied fertilizer to their tea and felt that the amount of fertilizer available to them was adequate. Again, it was concluded that all the farmers used labour on their farms whereby majority of them engaged labour of 1-7 workers on their farms. It was further concluded that majority of the tea farmers had adequate labour to pluck tea and were satisfied with the tea collection services.

5.3 Recommendations

The research was able to bring up some insights and more knowledge regardingthe influence of ecological and social economic factors on the level of tea production in Nandi Hills Sub-County. Given this, the following recommendations are made based on the research findings.

The government through the Tea Board of Kenya should offer incentives in pests and diseases control to small holder tea farmers in Nandi Hills to address some of the inadequacies in pests control and level of tea production. Farmers should work closely with themetrological department to ensure they can timely cope up with variations in rainfall and temperature.

Extension services and support to the farmers from factories and other stakeholders should be enhanced. There is need to investigate which type of training is the most (cost)-effective in the dissemination of information to smallholder tea farmers.

The relationship between farmers with their factories should be strengthened. Farmers need to have greater ownership and management stake in the factories. This will enable them to receive a sustainable price and negotiate effectively with factory management and by extension KTDA. This may also improve the logistics of tea collection.

This study also recommends further research to investigate the cultural aspect of tea production about poverty levels for this may assist farmers to treat tea farming as a business.

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APPENDIX 1: LETTER OF INTRODUCTION

October, 2017

Dear Respondent

REF: REQUEST FOR DATA

I am anundergraduatestudent in taking a degree course in development studies at The Management University of Africa. I am required to submit as part of my course work assessment, a research thesis report on "ECOLOGICAL AND SOCIAL ECONOMICAL FACTORS INFLUENCING THE LEVEL OF TEA PRODUCTION IN NANDI HILLS SUB-COUNTY"

To achieve this, you have been selected randomly as a respondent of the study. I kindly request you to fill the attached questionnaire to generate data required for this study. This information will be used purely for academic purpose and your name will not be mentioned in the report. Findings of the study, shall upon request, be availed to you.

Your assistance and cooperation will be highly appreciated.

Thank you in advance.

ELIZABETH NABEA (Ms)

UNDERGRADUATE STUDENT - RESEARCHER

APPENDIX II: RESEARCH STUDY QUESTINNAIRE

QUESTIONNAIRE FOR FARMERS

This questionnaire has been designed to collect information on the influence of ecological and social economic factors on the level of tea production in Nandi Hills Sub-County for academic purposes only. The questionnaire is divided into five sections. Section A seeks to capture the profile of respondents while section B-E will capture issues pertaining to the specific objectives of the study. Please complete each section as instructed. Do not write your name or any other form of identification on the questionnaire. All the information in this questionnaire will be treated in confidence.

Section A: Demographic information

1. Gender of respondents

Male ☐

Female ☐

2. How old are you? (Years)

18-27 ☐

28-37 ☐

38-47 ☐

Above 47 ☐

3. Which factory do you deliver your tea leaves to?

Chebarus ☐

Chematich ☐

Chemomi ☐

Kaplelmet ☐

Taito ☐

Section B: Ecological factors influencing the level of tea production

4. To what extent hadrainfall variation affected your tea Crop?

Not at all ☐

Very Little ☐

Little ☐

Somewhat ☐

Great extent ☐

5. To what extent had temperature variation affected your tea Crop?

Not at all ☐

Very Little ☐

Little ☐

Somewhat ☐

Great extent ☐

6. How often do you experience Pests and Diseases invasion on your farm?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

7. How often do you experience soil erosion on your farm?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

Section C:Social factors influencing the level of tea production

8a). Have you received training by agricultural extension officers in last one year?

Yes ☐

No ☐

8b) If Yes, how many times?

Once ☐

Twice ☐

Thrice ☐

More than thrice ☐

9. How do you rate the number of annual trainings given to tea farmers?

Not enough ☐

Enough ☐

More than enough ☐

Excessively many ☐

Section D:Economic factors influencing the level of tea production

10a). Do you use fertilizers in your farming activity?

Yes ☐

No ☐

10b). If yes, is the amount of fertilizer adequate?

Yes ☐

No ☐

11a). How many pluckers do you engage in your farm? (Employed or family members)

1-7 workers ☐

8-14 workers ☐

15 and above workers ☐

11b). If Yes, is the number adequate?

Yes ☐

No ☐

12. Rate your level of satisfaction with green leaf collection by the factory.

Extremely dissatisfied ☐

Dissatisfied ☐

Neutral ☐

Satisfied ☐

Extremely satisfied ☐

Section E:Level of tea production

13. How many kilograms of green tea leaves did deliver to the factory the whole of last year?

100-1500 kgs ☐

1600-3000 kgs ☐

3100-4500 kgs ☐

4600-6000 kgs ☐

6100-7500 kgs ☐

7600-9000 kgs ☐

9100-10500 kgs ☐

APPENDIX III: INFORMED CONSENT FORM